Effects of Mangosteen Peel (Garcinia mangostana) and Ginger Rhizome (Curcuma xanthorrhiza) on the Performance and Cholesterol Levels of Heat-stressed Broiler Chickens

by Sri Hidanah

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Research Article

Effects of Mangosteen Peel (*Garcinia mangostana*) and Ginger Rhizome (*Curcuma xanthorrhiza*) on the Performance and Cholesterol Levels of Heat-stressed Broiler Chickens

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Abstract

Objective: The objective of the present study was to determine the effects of mangosteen peel and ginger rhizome on the performance and cholesterol levels of heat-stressed broiler chickens. **Materials and Methods:** One hundred unsexed day-old commercial broiler chicks were fed one of four experimental diets. Diet T1, the control treatment, contained neither mangosteen peel nor ginger rhizome, diets T2 and T3 contained 5% mangosteen peel and 5% ginger rhizome, respectively and diet T4 contained 2.5% of both mangosteen peel and ginger rhizome. **Results:** The results indicated that the consumption of diet T4 was significantly higher than that of the other three diets ($p<0.05$). The mean live weight of broilers fed diets T2 and T4 was significantly greater ($p<0.05$) than that of broilers fed the control diet. The abdominal fat ratios and cholesterol levels of broilers fed diets T3 and T4 were significantly higher ($p<0.05$) than that of broilers fed the control diet. **Conclusion:** The performance of broiler chickens can be enhanced by the addition of mangosteen peel or a combination of mangosteen peel and ginger rhizome to feed formulations.

Key words: Cholesterol, mangosteen peel, ginger rhizome, performance, heat stress

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Temperature is one of the main factor that negatively affect the performance of broilers and the resulting heat stress threatens broiler farming in tropical countries, such as Indonesia. Heat-stress has several effects on the health and performance of broiler chickens, which are more susceptible to heat load than slower-growing domestic fowl[1,2]. Hansen *et al.*[3] predicted that heat-stress related complications would become more frequent as a result of global warming. Broiler chickens are intensively selected for high growth rates, however, supporting physiological systems have not been considered during selection[4,5]. Therefore, when ambient temperatures exceed the thermoneutral zone of broilers, various physiological disorders can appear[6,7]. Several studies have shown that heat-stress impacts the performance, physiology and productivity of chickens, resulting in death and economic losses[8-12].

In order to remedy the negative effects of heat-stress, feed additives, such as mangosteen peel and ginger rhizome have been used as a dietary approach. Mangosteen peel is a byproduct of mangosteen (*Garcinia mangostana*) processing and contains active compounds such as xanthone and its derivatives[13] that possess pharmacological properties, including antioxidant activity. Ginger rhizome, which is widely used as a culinary spice and herbal remedy possesses compounds with strong antioxidant activities, including gingerol, gingerdione and gingerdione[14].

Accordingly, the objective of the present study was to investigate whether mangosteen peel and ginger rhizome could improve the performance and cholesterol levels of heat-stressed broiler chickens.

MATERIALS AND METHODS

This study was conducted at the Faculty of Veterinary Medicine, Airlangga University, Surabaya, East Java, Indonesia. One hundred unsexed day-old broiler (Cobb 500) chicks were divided into 4 treatment groups, each group consist 25 broiler chicks with four replicates, using a completely randomized design. The broiler chickens were housed in an environmentally controlled room, with a constant temperature of 31°C and continuous light. In order to boost their immunity, the chicks were vaccinated against Newcastle disease and infectious bronchitis at 8 and 28 days old and the Gumboro vaccine was administered on day 14 of the experiment.

The dried mangosteen peel and ginger rhizome used in this experiment were obtained from a local market and then ground into powder. Four diets (T1-T4) were formulated to meet the nutrient requirements of the broilers. Diet T1, the control treatment, contained neither mangosteen peel nor ginger rhizome, diets T2 and T3 contained 5% mangosteen peel and 5% ginger rhizome, respectively and diet T4 contained 2.5% of both mangosteen peel and ginger rhizome (Table 1).

Table 1: Nutrient composition and metabolizable energy content of basal diets (as-fed)

Metabolizable Energy (ME)	kcal kg^{-1}	Starter diets (day 1-21)	Finisher diets (day 22-)
Dry matter	%	Max 12.0	Max 12.0
Crude protein	%	Min 21.0	19.0-21.0
Ether extract	%	Min 5.0	5.0-7.0
Crude fiber	%	Max 4.0	Max 5.0
Ash	%	Max 6.5	Max 7.0
Calcium	%	0.9-1.2	0.9-1.1
Phosphor	%	0.7-0.9	0.6-0.8
Coccidiostat		+	+
Antibiotic		+	+

Feed consumption (gram per bird) was recorded weekly at each replication by weighing the remaining diet. Broilers were sacrificed on day 35 in the trial. The carcasses were chilled in cold water, then abdominal fat and carcasses of all animals were weighted separately to determine the carcass and abdominal fat ratio of each broiler. Furthermore, the meat cholesterol was evaluated from samples of breast meat using an enzycromatic cholesterol assay kit (Cat# ECCH-100, Bioassay Systems, USA) with a microplate reader at a wavelength of 340 nm.

Statistical analysis: Data were analyzed using an analysis of variance (ANOVA) from the Statistical Package for the Social Sciences (SPSS version 21.0). A Duncan's multiple range test was applied to determine differences among treatments. Differences were considered significant at the 5% level.

RESULTS AND DISCUSSION

Neither the mangosteen peel or ginger rhizome supplementation significantly altered body weight gain ($p>0.05$) and neither supplement affected mean cumulative feed consumption alone (diets T2 and T3, $p>0.05$), although the combination of supplements (diet T4) significantly increased feed consumption ($p<0.05$). Moreover, both mangosteen peel (diet T2) and the combined treatment (diet T4) increased the live weight of broilers over that of broilers fed the control treatment (diet T1). In addition, the proportion of carcass weight was not affected by either supplement ($p>0.05$, Table 2) and that of abdominal fat was not significantly affected by mangosteen peel alone (diet T2,

Table 2: Effect of supplementations of mangosteen peel and ginger rhizome on the percentage of carcass and percentage of abdominal fat

	Mangosteen peel and ginger rhizome level (%)			
Parameters (%)	T1	T2	T3	T4
Carcass	73.02±1.58	72.96±1.18	73.79±2.56	73.24±1.71
Abdominal fat	1.20±0.19^{ab}	1.21±0.16^{ab}	1.34±0.40^{b}	1.01±0.21^{a}

^{a,b}Values in the same row with different superscripts indicate significant difference at p<0.05

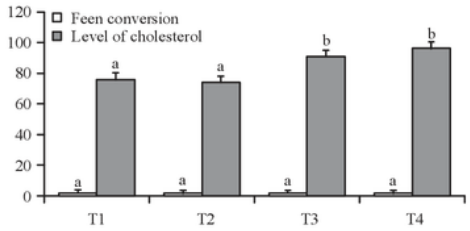

Fig. 1: Percentage response of cholesterol level and feed conversion after addition mangosteen peel and ginger rhizome in broiler chicken

p>0.05) but it was significantly increased by ginger rhizome (diet T3, p<0.05) and significantly reduced by the combined treatment (diet T4, p<0.05, Table 2). On the other hand, none of the supplemented feeds affected feed conversion (p>0.05, Fig. 1) and the cholesterol levels of broilers fed the control (diet T1, 76.20±3.88) and mangosteen-supplemented (diet T2, 74.20±3.50) diets were similar (p>0.05), whereas the cholesterol levels of broilers fed diets supplemented with ginger rhizome (diet T3, 91.20±4.13) and both mangosteen peel and ginger rhizome (diet T4, 96.52±4.91) were significantly higher (p<0.05, Fig. 1).

The results of this study indicate the effect of supplements of mangosteen peel and ginger rhizomes on the body weight gain of broiler chickens exposed heat- stress was similar between the control (without mangosteen peel and ginger rhizomes) and all treatment groups. These findings confirmed the results of a study conducted by Abu-Dieyeh[15], who reported that the body weight gain of birds reared at 35°C was significantly lower than that of birds reared at 21-30°C. Furthermore, feed consumption of the treatment group, T4 was higher than that of other treatment groups. These findings concur with those reported by Rusli *et al.*[16], who stated that mangosteen pericarp meal had no influence on poultry performance.

In the present study, mangosteen peel and ginger rhizome supplementation significantly affected the live weight of heat-stressed broiler chickens (p<0.05, Table 3), with the live weight of the mangosteen peel (diet T2) and combination (diet T4) treatment groups higher than that of the control group (diet T1). This result supports the findings of Palapol *et al.*[17], who also reported that the addition of mangosteen peel affects the live weight of broiler chickens. Furthermore, Jung *et al.*[13] and Palapol *et al.*[17] reported that mangosteen peel contains a variety of active compounds, namely xanthone and its derivatives, including α-mangostin, γ-mangostin, mangostinon, mangostingon, 8-hydroxycudraxanthone G, cudraxanthone G, 8-deoxygartanin, garcimangosone B, garcinone D, garcinone E, gartanin, 1-isomangostin, smeathxanthone A, tovophyllin A, anthocyanins, saponin and tannin and these compounds have been reported to possess a variety of pharmacological properties, including antioxidant[13], anti-tumor, antibacterial and anti-malaria activities[18]. In addition, Azhir *et al.*[14] reported that ginger rhizome can improve the digestion of broiler chickens. Therefore, the combination of the two supplements, mangosteen peel and ginger rhizome is also likely to improve the performance of broiler chickens, including their live weight.

Along with weight gain and live weight, the present study also aimed to assess the influence of mangosteen peel and ginger rhizome on the proportion of carcass weight attributed to abdominal fat. The data indicated that the weight ratio of abdominal fat to carcass was higher for the group fed the ginger-supplemented diet (diet T3) than for the control group (diet T1). However, the ratio for the combined treatment (diet T4) group was lower than that for the control group and the mechanism underlying the observed variation in abdominal fat is not fully understood. The average proportion of carcass weight attributed to abdominal fat (1.19±0.25) was also lower than that previously reported. For example, Balevi and Coskun[19] reported that the abdominal fat percentage of 4-8 week-old broiler chickens was 2-3.13% of the live weight. The low proportion observed in the present study suggests that most of the experimental animals were heat-stressed at the ambient temperature of 31°C. Indeed, the normal temperature of poultry ranges from 18-24°C[20] and temperatures that exceed this range may influence thermoregulation, as well as the proportion of abdominal fat. On the other hand, Furlan *et al.*[21] reported that low protein diets affect the abdominal fat deposits of broiler chickens.

Table 3: Effect of supplementations of mangosteen peel and ginger rhizome on body weight gain, feed consumption and live weight

	Mangosteen peel and ginger rhizome level (%)			
Parameters (g)	T1	T2	T3	T4
Body weight gain	63.86±4.21	66.71±2.70	64.86±3.17	70.00±1.43
Feed consumption	117.07±1.97[a]	116.71±1.44[a]	115.71±4.03[a]	122.43±4.53[b]
e weight	1404.00±103.58[a]	1420.[illegible]±22.36[ab]	1388.00±51.67[a]	1494.00±35.77[b]

[a,b]Values in the same row with different superscripts indicate significant difference at p<0.05

In the present study, meat from the combined treatment (diet T4) group exhibited a higher cholesterol level (96.52±4.91 mg dL^{-1}) than the other treatment groups, although the difference between the combined treatment (diet T4) group and the ginger rhizome (diet T3) group (91.20±4.13) was not significant (p>0.05). However, the mangosteen peel treatment (diet T2) group yielded the lowest cholesterol level (76.20±3.88). These findings confirm the results of Zaboli *et al.*[22] and Jung *et al.*[13], who reported that the active compounds in mangosteen peel, like xanthone and its derivatives, possess pharmacological properties, including antioxidant activity and the average level of cholesterol observed in the present study was lower than the 100 mg cholesterol per 100 g broiler meat reported by Chan *et al.*[23].

CONCLUSION

The results of the present study demonstrate that the performance of broiler chickens can be enhanced by the addition of mangosteen peel or a combination of mangosteen peel and ginger rhizome to feed formulations. In addition, the addition of ginger rhizome or a combination of mangosteen peel and ginger rhizome increases the cholesterol levels of broiler meat and the combined addition of mangosteen peel and ginger rhizome also increases feed consumption.

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REFERENCES

1. Abdelqader, A. and A.R. Al-Fataftah, 2014. Thermal acclimation of broiler birds by intermittent heat exposure. J. Thermal Biol., 39: 1-5.
2. Lin, H., H.C. Jiao, J. Buyse and E. Decuypere, 2006. Strategies for preventing heat stress in poultry. World Poult. Sci. J., 62: 71-86.
3. Hansen, J., R. Ruedy, M. Sato and K. Lo, 2010. Global surface temperature change. Rev. Geophys., Vol. 48. 10.1029/2010RG000345.
4. Gous, R.M., 2010. Nutritional limitations on growth and development in poultry. Livest. Sci., 130: 25-32.
5. Havenstein, G.B., P.R. Ferket and M.A. Qureshi, 2003. Growth, livability and feed conversion of 1957 versus 2001 broilers when fed representative 1957 and 2001 broiler diets. Poult. Sci., 82: 1500-1508.
6. Rozenboim, I., E. Tako, O. Gal-Garber, J.A. Proudman and Z. Uni, 2007. The effect of heat stress on ovarian function of laying hens. Poult. Sci., 86: 1760-1765.
7. Sohail, M.U., M.E. Hume, J.A. Byrd, D.J. Nisbet and A. Ijaz *et al.*, 2012. Effect of supplementation of prebiotic mannan-oligosaccharides and probiotic mixture on growth performance of broilers subjected to chronic heat stress. Poult. Sci., 91: 2235-2240.
8. Gu, X.H., Y. Hao and X.L. Wang, 2012. Overexpression of heat shock protein 70 and its relationship to intestine under acute heat stress in broilers: 2. Intestinal oxidative stress. Poult. Sci., 91: 790-799.
9. Guerreiro, E.N., P.F. Giachetto, P.E.N. Givisiez, J.A. Ferro, M.I.T. Ferro and J.E. Gabriel *et al.*, 2004. Brain and hepatic Hsp70 protein levels in heat-acclimated broiler chickens during heat stress. Brazil J. Poult. Sci., 6: 201-206.
10. Mashaly, M.M., G.L. Hendricks, M.A. Kalama, A.E. Gehad, A.O. Abbas and P.H. Patterson, 2004. Effect of heat stress on production parameters and immune responses of commercial laying hens. Poult. Sci., 83: 889-894.
11. Mazzi, C.M., J.A. Ferro, M.I.T. Ferro, V.J.M. Savino, A.A.D. Coelho and M. Macari, 2003. Polymorphism analysis of the hsp70 stress gene in Broiler chickens (*Gallus gallus*) of different breeds. Genet. Mol. Biol., 26: 275-281.
12. St-Pierre, N.R., B. Cobanov and G. Schnitkey, 2003. Economic losses from heat stress by US livestock industries. J. Dairy Sci., 86: E52-E77.
13. Jung, H.A., B.N. Su, W.J. Keller, R.G. Mehta and A.D. Kinghorn, 2006. Antioxidant xanthones from the pericarp of *Garcinia mangostana* (Mangosteen). J. Agric. Food. Chem., 54: 2077-2082.
14. Azhir, D., A. Zakeri and A. Kargare-Rezapour, 2012. Effect of ginger powder rhizome on homural immunity of broiler chickens. Eur. J. Exp. Biol., 2: 2090-2092.

15. Abu-Dieyeh, Z.H.M., 2006. Effect of chronic heat stress and long-term feed restriction on broiler performance. Int. J. Poult. Sci., 5: 185-190.
16. Rusli, R.K., K.G. Wiryawan, T. Toharmat, Jakaria and R. Mutia, 2015. Effect of mangosteen pericarp meal and vitamin e supplements on the performance, blood profiles, antioxidant enzyme and HSP 70 gene expression of laying hens in tropical environment. Int. J. Poult. Sci., 14: 570-576.
17. Palapol, Y., S. Ketsa, D. Stevenson, J.M. Cooney, A.C. Allan and I.B. Ferguson, 2009. Colour development and quality of mangosteen (*Garcinia mangostana* L.) fruit during ripening and after harvest. Postharvest Biol. Technol., 51: 349-353.
18. Pedraza-Chaverri, J., N. Cardenas-Rodriguez, M. Orozco-Ibarra and J.M. Perez-Rojas, 2008. Medicinal properties of mangosteen (*Garcinia mangostana*). Food. Chem. Toxicol., 46: 3227-3239.
19. Balevi, T. and B. Coskun, 2000. Effects of some oils used in broiler rations on performance and fatty acid composition in abdominal fat. Revue Medecine Veterinaire, 151: 937-944.
20. Vinoth, A., T. Thirunalasundari, J.A. Tharian, M. Shanmugam and U. Rajkumar, 2015. Effect of thermal manipulation during embryogenesis on liver heat shock protein expression in chronic heat stressed colored broiler chickens. J. Thermal Biol., 53: 162-171.
21. Furlan, R.L., D.E. de Faria Filho, P.S. Rosa and M. Macari, 2004. Does low-protein diet improve broiler performance under heat stress conditions? Revista Brasileira Ciencia Avicola, 6: 71-79.
22. Zaboli, G.R., H.H. Bilondi and A. Miri, 2013. The effect of dietary antioxidant supplements on abdominal fat deposition in broilers. Life Sci. J., 10: 328-333.
23. Chan, W., W.C. Brown, S.M. Lee and D.H. Buss, 1995. Meat, Poultry and Gane. In: The Composition of Foods, McCane, R.A. and E.M. Widdowson (Eds.). 5th Edn., The Royal Society of Chemistry Cambridge, London.

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